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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/713,215	11/17/2003	Tae-Wan Kim	249/392	2486

7590 08/21/2006

LEE & STERBA, P.C.  
1101 Wilson Boulevard, Suite 2000  
Arlington, VA 22209

EXAMINER

BERNATZ, KEVIN M

ART UNIT	PAPER NUMBER
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1773

DATE MAILED: 08/21/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/713,215

Applicant(s)

KIM ET AL.

Examiner

Kevin M. Bernatz

Art Unit

1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,2 and 4-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2 and 4-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |  |
|---|--|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date ____ | 6) <input type="checkbox"/> Other: ____  |

## **DETAILED ACTION**

### ***Response to Amendment***

1. Amendments to claim 1, filed on June 9, 2006, have been entered in the above-identified application.
2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

### ***Request for Continued Examination***

3. The Request for Continued Examination (RCE) under 37 CFR 1.53 (d) filed on June 9, 2006 is acceptable and a RCE has been established. An action on the RCE follows.

### ***Claim Rejections - 35 USC § 102***

4. Claims 1, 2 and 4 – 8 are rejected under 35 U.S.C. 102(e) as being anticipated by Hiramoto et al. (U.S. Patent No. 6,771,473 B2) for the reasons of record as set forth in Paragraph No. 3 of the Office Action mailed on January 9, 2006.

Regarding the amended limitation “the pinned layer having a nitrogen-plasma-processed first surface on which the tunnel barrier is directly arranged”, the Examiner notes that this limitation(s) are/(is a) process limitation(s) and is/are not further limiting in terms of the structure resulting from the claimed process. Specifically, in a product claim, as long as the prior art product meets the claimed structural limitations, the

Art Unit: 1773

method by which the product is formed is not germane to the determination of patentability of the product unless an unobvious difference can be shown to result from the claimed process limitations. In the instant case, the structure resulting from the disclosed process is deemed the following: the pinned layer must possess a first surface containing nitrogen that is directly adjacent the tunnel barrier layer (see Table I below). Furthermore, the Examiner notes that Hiramoto et al. disclose using nitrogen plasma to form the nitrogen containing layers (*col. 6, lines 38 – 43*).

Table I: Illustration of Hiramoto et al. and claimed structure

Claimed Structure	Structure of Hiramoto et al. embodiment 3 ( <i>col. 13, lines 48 – 63 and Table 3</i> )
Free layer	{NiFe/CoFe}
Barrier layer – second surface	NiMnSb
Barrier layer – high N region	Al <sub>2</sub> O <sub>3</sub> replaced with AlN, AlON or BN ( <i>see below</i> )
First surface – high N region	FeN
Pinned – first surface	FeN
Pinned – second surface	Co/Ru/Co
Pinning	Cr
Seed	Ta/Cu
Substrate	Silicon

The Examiner notes that the FeN at the first surface of the pinned layer structure contains more nitrogen than at the second surface of the pinned layer structure, since the second surface contains 0% nitrogen.

The Examiner notes that the barrier layer laminates in Table 3 disclose non-nitrogen containing compounds with  $\text{Al}_2\text{O}_3$  layers on either side. Hiramoto et al. clearly teach that this structure is of the form “a high barrier film/a low barrier film/a high barrier film” (*col. 3, lines 36 – 39*), where the high barrier film is “selected from AlN, AlON,  $\text{Al}_2\text{O}_3$  and BN” (*col. 3, lines 33 – 36*). Given the specificity by which Hiramoto et al. discloses the high barrier layers (i.e. 3 of the 4 choices are nitrogen containing compounds), the Examiner deems there is sufficient specificity to anticipate a structure of a nitrogen containing first barrier layer directly on the FeN pinned layer with a non-nitrogen containing “low barrier film”, as taught in Table 3. Such a structure would read on the limitation of the nitrogen rich region at the interface of the ... tunnel barrier layer (*e.g. AlN, AlON or BN*) containing more nitrogen than the tunnel barrier contains at a second surface of the tunnel barrier opposite to the interface (*e.g. the NiMnSb layer*).

Regarding claims 2 and 4 – 8, Hiramoto et al. is relied upon as previously described.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1, 2 and 4 – 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiramoto et al. ('473 B2) as applied above.

Hiramoto et al. is relied upon as described above.

While the Examiner maintains there is sufficient specificity to anticipate the claimed limitations, the Examiner acknowledges that Hiramoto et al. fail to explicitly disclose an embodiment possessing a multi-layered tunnel barrier layer directly adjacent a FeN pinned layer wherein the tunnel barrier layer adjacent the FeN pinned layer is a nitrogen containing layer and a tunnel barrier layer opposite the pinned layer is a non-nitrogen containing layer.

However, Hiramoto et al. explicitly teach embodiments comprising a FeN layer adjacent a tunnel barrier layer, as well as tunnel barrier layers comprising  $\text{Al}_2\text{O}_3$ /non-nitrogen containing layer/  $\text{Al}_2\text{O}_3$  (*embodiment 3*). Furthermore, Hiramoto et al. teach the equivalence of  $\text{Al}_2\text{O}_3$  and AlN, AlON and BN for the exterior layers of a three-layered laminate (*col. 3, lines 33 – 39*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Hiramoto et al. to utilize a structure comprising FeN/AlN/non-nitrogen containing layer/ $\text{Al}_2\text{O}_3$  as taught by Hiramoto et al.

since substituting an AlN layer for an  $\text{Al}_2\text{O}_3$  is merely substitution of a known functional and structural equivalent.

### ***Response to Arguments***

**7. The rejection of claims 1, 2 and 4 - 8 under 35 U.S.C § 102(e) and/or 103(a) – Hiramoto et al.**

Applicant's arguments have been considered but are moot in view of the new basis of rejection. Furthermore, the Examiner notes that applicants' arguments have been addressed in the prior advisory action, mailed May 4, 2006.

### ***Conclusion***

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

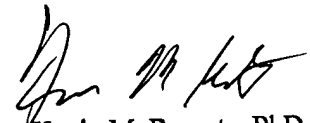
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carol Chaney can be reached on (571) 272-1284. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1773

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KMB

August 16, 2006



Kevin M. Bernatz, PhD  
Primary Examiner